GLAST CDRL

CONTRACT DATA REQUIREMENTS

FOR

NASA's
GAMMA RAY LARGE AREA TELESCOPE (GLAST)
MISSION

ATTACHMENT I

AUGUST 30, 2002

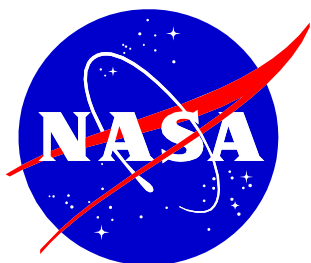## GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

GLAST CDRL

CONTRACT
DATA REQUIREMENTS

FOR

NASA's GAMMA RAY LARGE AREA TELESCOPE (GLAST) MISSION

ATTACHMENT I

August 30, 2002

NASA Goddard Space Flight Center

Greenbelt, Maryland 20771

CHANGE RECORD PAGE

DOCUMENT TITLE: GLAST CDRL Contract Data Requirements for NASA's Gamma Ray Large Area Telescope (GLAST) Mission
DOCUMENT DATE: August 30, 2002

ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
Original	08/30/02	All	Contract Version. CCR 433-0062
CH-01	01/23/03	ii, 5, 41 and 42	CCR 433-0077.
CH-02	10/20/03	ii, 4, 5, 15-18 and 35	CCR 433-0147 R1.
CH-03	01/23/04	ii and 39.	CCR 433-0198 R1.
CH-04	03/04/04	ii, 8, 9 and 10.	CCR 433-0233.
CH-05	03/24/04	ii, 4, 5, 13 and 14.	CCR 433-0210 R1.
CH-06	06/10/04	ii and 6	CCR 433-0228

TABLE OF CONTENTS

SECTION 1 - Introduction

1.1   <u>Scope</u>

   a)   The Contract Data Requirements List (CDRL) is the basic contractual document which governs data required by and for the GLAST delivery order.

   b)   The contractor shall furnish data described by the Data Item Descriptions (DIDs) included herein and listed on the Data Requirements Lists (DRLs) for each item of data.

   c)   All data shall be prepared, maintained, and delivered to NASA in accordance with the requirements of this CDRL.

1.2   <u>Data Requirements List (DRL)</u>

The DRLs provide a complete listing of the data requirements of the contract. Each DRL contains the following:

   a)   The data item number, which corresponds to the data item description number.

   b)   The data item title.

   c)   The data item approval code defined as follows:

   1.   Code A: The initial submission and all subsequent changes require approval of the NASA contracting officer prior to implementation.
   2.   Code I: Deliverables are sent to NASA for information. NASA will request changes on deliverables where errors or omissions are noted.

   d)   The data item submission dates are as follows:

   1.   Mini-Proposal: Due at response to GLAST mission specific Delivery Order.
   2.   Date Specific - Management information needed on a monthly basis and for items to meet external interface milestones.

1.3   <u>Data Items Description</u>

   a)   Each data requirement listed on the DRL is defined by a DID.

   b)   The DID describes the purpose and required content of the data item, and provides specific format and preparation instructions as necessary.

   c)   Much of the information requested in the DIDs may already exist in your documentation and format. We strongly encourage using your existing documents and formats whenever it will meet the requirements of the DID.

1.4 Distribution and Delivery

The contractor shall distribute and deliver data according to contract requirements and provisions. The data shall be delivered to the following address distribution codes as annotated on the DRL:

> A - Goddard Space Flight Center
> GLAST Project Office Library
> Code 490
> Greenbelt, MD 20771

The contractor shall deliver electronic data sent via email to the contracting officers. Contracting officer's and other email addresses to be specified.

The contractor shall notify the contracting officer, at an email address to be specified, of electronic data made available for transfer by ftp or website.

In addition to the above, the original transmittal letter for all deliverables shall be addressed to:

> B - Goddard Space Flight Center
> GLAST Project, Contracting Officer
> Code 490
> Greenbelt, MD 20771

The following shall be provided for each data item submission:

a) Copy of Record - The Copy of Record is the official file copy submitted in the form in which it is intended to be distributed and marked "Copy of Record" and suitable for reproduction.

b) Copies - Copies of each document specified in the DRL shall be delivered in a condition suitable for immediate distribution.

c) Electronic Data Delivery - Formats for electronic media delivery are defined in paragraph 1.5 of this CDRL. Delivery of electronic media data items shall occur per the same delivery schedule as printed media.

1.5 Delivery Media

a) There are two media in which data will be documented and are defined as:

1. Hard Copy - Data typed, drawn or printed on paper by common, conventional practices. By these means, either the original, a reproducible copy or the record copy shall be reproduced for distribution as printed copies.

2. Electronic - Data which is recorded in word processors, computerized data processing systems, or electronic storage devices such as magnetic tapes, disks and CD ROM.
3. The contractor shall be capable of supplying electronic data to GSFC by email, ftp, secure email, secure ftp, CD, and DVD discs. Unless otherwise specified in this document the transfer means shall be specified on a case-by-case basis, depending upon data size and security requirements.

4. The contractor shall supply electronic data in PDF format , whenever possible, and in a form that is mutually agreed upon by the contractor and the GLAST project office.

b) Documentation delivery (in hardcopy or electronic format) shall be as specified in the CDRL. Additionally, all CDRL data which has been generated electronically shall be delivered via electronic transfer or electronic transfer media such as disks.

c) The instructions to facilitate the use of electronic media are to be supplied.

1.6 <u>Documentation Change Procedures</u>

a) The contractor shall issue documentation change notices (DCNs) whenever minor changes or updates occur in data items that have been delivered to NASA.

b) Change bars shall be used to indicate changes or updates.

c) When major changes to a document are made a complete revision of the document shall be issued and delivered to NASA in accordance with the original instructions for the data item.

d) No change bars are used when a document is updated by revision and the DCN numbers for that document shall be automatically recycled to 001.

DID #	GLAST CDRL SUMMARY Title	A/I	Submission Date(s)	Media	Copies/ code
1	External Interfaces, Models and Analysis	A	A. For structural models - Prelim @ SRR + 3 months and SC PDR; Final design @ SC CDR/Final instrument-correlated model(s) @ PER; B. Structural Interface Stress Analysis – Prelim @ SC PDR, Updates at SC CDR and PER; C. Pointing and Alignment Budgets – Prelim @ SC PDR, Final at SC CDR + 5 months; D. Spacecraft Bus and Observatory Thermal Models & Analysis – @ SC PDR, Final @ SC CDR, and updates @ PER & PSR; E. Ground System Protocols and Data Rates Compatibility Analysis – Prelim @ SC PDR; Final @ SC CDR; F. Data Contact Scenarios and Optimization – Prelim @ SC PDR, Final @ SC CDR; G. Flight Dynamics and Orbital Maintenance Analysis - @ SC PDR and @ SC CDR;	E/H	2

CH-05

DID #	GLAST CDRL SUMMARY Title	A/I	Submission Date(s)	Media	Copies/ code
			H. Notification of receipt of CLA from KSC & LV contractor to GLAST CO - within 2 days of receipt;		
			I. Sine vibe test specs for all GBM components - 3 months following each CLA;		
			J. Random Vibe Test Spec for all GBM components - 3 months following first CLA cycle; updates as generated;		CH-05
			K. Results of Base Drive Observatory Analysis - 3 months following each CLA;		
			L. Load Transfer Matrices for Recovery of GBM Component Responses & GBM responses - @ 1 month following each CLA cycle;		
			M. Quasi-Static Design Limit Loads for all GBM components @ 1 month following each CLA cycle;		

433-CDRL-0002

GLAST CDRL SUMMARY Title		A/I	Submission Date(s)	Media	Copies/ code	
2	Instrument Interface Control Documents (ICDs) ; 2A – LAT ICD, 2B – GBM ICD	A	Prelim @ MPDR; intermediate @ MPDR +3 months; Final @ SC CDR, and updates as required.	E/H	2	CH-06
3	Launch Vehicle Documentation (LVD)	A	Prelim @ MCDR/Final @ L-18 months	E/H	2	
4	Observatory-Ground Network Interface Control Doc. (Obs to GN ICD)	A	Prelim SCCDR - 1 month Final SCCDR +7 months	E/H	2	
5	Observatory Operations Description Manual	A	Prelim SCCDR + 6 months Intermediate PER - 2 months Final PSR - 2 months	E/H	2	CH-02
6	Telemetry and Command Handbook	A	Prelim SCCDR Intermediate PER Final PSR	E/H	3	
7	Flight Operations Plan	A	Prelim SCCDR + 6 months Final PSR- 2 month	E/H	2	
8	Observatory Launch Site Ops and Test Plans	A	Prelim @ MCDR/Final @ L – 12 months	E/H	2	
9	Observatory Launch Site Operations and Test Procedures	A	Prelim @ PER, Final @ PSR - 3 months	E/H	2	
10	Transportation and Handling Plan	A	Prelim @ MCDR, Final @ /PER	E/H	2	
11	Engineering Change Proposals (ECPs), Deviations & Waivers	A	As Generated	E/H	2	
12	Software Management Plan (SMP)	A	Prelim @ SRR, Final @MPDR	E/H	2	

DID #	GLAST CDRL SUMMARY Title	A/I	Submission Date(s)	Media	Copies/ code	
13	Software Requirements Specification (SRS)	A	Prel @ SRR, Final @MPDR	E/H	2	
14	Software Design Document (SDD)	I	Final @ MCDR	E/H	2	
15	Software Test Package (STP)	I	Plan Section Draft @ MPDR/Final @ MCDR; Procedure Section Draft @ MCDR/Final @ TRR; Reports (ATR)	E/H	2	
16	DELETED		N/A	N/A	N/A	
17	DELETED		N/A	N/A	N/A	
18	Version Description Document (VDD)	I	With Each Version Delivery	E/H	2	
19	Flight Software User and Maintenance Manual (SUMM)	A	Draft @ ATR; Final @ Launch	E/H	2	
20	DELETED		N/A	N/A	N/A	
21	Flight Software Review Packages	I	Review date - 1 week	E/H	2	
22	DELETED		N/A	N/A	N/A	
23	Observatory-Space Network Interface Control Doc. (SC-SN ICD)	I A	Prelim SCCDR - 1 month Final SCCDR+7 months	E/H	2	CH-02
24	Mission Program Status Review (MPSR) Package	I	@ each MPSR	E/H	2	
25	Weekly Status Report	I	@ each Weekly	E	2	
26	DELETED		N/A	N/A	N/A	
27	Observatory photographs and video tapes	I	Quarterly throughout I&T	E/H	2	
28	DELETED		N/A	N/A	N/A	
29	Observatory Detailed Requirements, Traceability and Verification	A	SRR, MCDR, and IRR	E/H	3	CH-01
30	GLAST Project Control Plan	I	Prelim @MPDR/ Final @ MCDR	E/H	2	
31	DELETED			N/A	N/A	
32	GN&C Detailed Design Document	A	Prelim @MPDR/Final @MCDR	E/H	2	

DID #	GLAST CDRL SUMMARY Title	A/I	Submission Date(s)	Media	Copies/ code
33	Definition of LAT Power Feeds	A	Prelim @ARO+1month/Final @ SRR	E/H	2
34	60 day On-Orbit Performance Verification Report	A	AR + 10 days	E/H	2
35	MOC Training Simulator Review Data Packages	A	Prelim @ MCDR/Final @ L-24 months	E/H	3
36	MOC Training Simulator Users, Operators and Maintenance Manuals	A	Prelim requirements@MCDR/Final @ ORR	E/H	3

	GLAST Priced Option CDRL Summary				
DID #	**Title**	**A/I**	**Submission Date(s)**	**Media**	**Copies/code**
Option –6	Battery Life Test Plan	A	Preliminary with submission of proposal/Final @ 3 months after activation of Option 6	E/H	2
Option – 13.1	MOC Ground System – System Concept Review Data Package	I	2 months after activation of Option 13	E/H	2
Option – 13.2	MOC Ground System Preliminary Design Review Data Package	I	8 months after activation of Option 13	E/H	2
Option – 13.3	MOC Ground System Critical Design Review Data Package	I	MCDR	E/H	2
Option 13.4	MOC Ground System Mission Operation Review Data Package	I	MOR	E/H	2
Option 13.5	MOC Ground System Flight Ops Review Data Package	I	ORR	E/H	2
Option 13.6	MOC Ground System Operations Manual	A	MOR	E/H	2
Option 13.7	MOC Ground System Test Plan		MOC CDR	E/H	2
Option 13.8	MOC Ground System Procedures	A	Preliminary @ MOR/updates concurrent with ground system builds/Final @ L-60 days	E/H	2
Option 13.9	MOC Facilities Plan	A	MOR	E/H	2
Option 13.10	Mission Operations Procedure	A	Preliminary @ MOR; updates concurrent with MOC software deliveries; Final @ L-60 days	E/H	2

CDRL for Safety and Mission Assurance Deliverables: Called-Out in the Spacecraft MAR

DID Ltr.	Description	Due Date, Maturity	A/I	
A	Discrepancy Reports (DR's) and Material Review Board (MRB) Reports	DR - Within 16 Work Hours of Preparation, Preliminary	I	
		DR - At Completion of Analysis & Assignment of Corrective Action, Current	I	
		Class 2 DR – After MRB Closure, Final	I	
		Class 1 DR - After MRB Closure, Final	A	
		Notice Within 5 Work Days of DR On Similar Hardware, Current	I	
		MRB Report - 5 Work Days After Each MRB Meeting, Final	I	
B	Non-Conformance Reports (NCR's) and Anomaly Review Board (ARB) Reports	NCR - Within 16 Work Hours of Occurrence, Preliminary	I	
		NCR - At Completion of Analysis & Assignment of Corrective Action, Current	I	
		"Non-Significant" NCR – After ARB Closure, Final	I	
		"Significant" NCR - After ARB Closure, Final	A	
		Notice Within 5 Work Days of NCR on Similar Hardware, Current	I	
		ARB Report - 5 Work Days After Each ARB Meeting, Final	I	
C	As-Built Hardware and Software Configured Items Lists	60 Days Prior to Hardware/Software Shipment, Final As Generated, Updates	I	CH-04
D	System Safety Implementation Plan	45 Days After Contract Award, Initial 45 Days Prior to MCDR, Final	A	CH-04
	Preliminary Hazard Analysis (PHA)	30 Days Prior to MPDR, Preliminary 30 Days Prior to MCDR, Final	A	
	Safety Noncompliance Reports	As Generated, Final	A	
	Hazards Control Verification Log	When Requested, Current	I	
	Ground Operations Plan (GOP) including Hazardous and Safety Critical Procedures	GOP -45 Days Prior to MCDR, Initial GOP - 45 Days Prior to the Observatory's Delivery to Range, Final Procedures - 15 Days Prior to First Run of Procedure, Final	A	

DID Ltr.	Description	Due Date, Maturity	A/I
E	Missile System Prelaunch Safety Package (MSPSP)	13.5 Months Prior to Observatory Shipment to Range, Initial 75 Days Prior to Observatory Shipment to Range, Final	A
F	Debris Generation Analysis Report	30 Days Prior to MPDR, Initial 65 Days Prior to MCDR, Final As Generated, Updates	I
G	Technical Reviews	GSFC Chaired/Co-Chaired Review Technical Material - 7 Work Days Prior to Review, Final Minutes and Action Items for Peer Reviews – 10 Work Days After Review, Final Responses to Government Requests for Action - Per Schedule Established at/for Review, Final Responses to Peer Review Action Items– After Closure, Final	I I A I
H	Spacecraft and Observatory Integration and Test (I&T) Plan	60 Days Prior to the MPDR, Initial 30 Days Prior to MCDR, Final As Generated, Updates Verification Procedures, Test Results, and Test Reports – Upon Request	A A A I
	Observatory Level Thermal Vacuum Test Plan	90 Days Prior to the Commencement of Observatory Level Thermal Vacuum Testing, Current As Generated, Updates	A
	Observatory Level Thermal Vacuum Test Correlation Report	21 Days After the Completion of Observatory Level Thermal Balance Vacuum Testing, Current As Generated, Updates	I
I	Observatory Performance Verification Plan	Plan - 60 Days Prior to the MPDR, Initial Plan - 30 Days Prior to MCDR, Final Plan - As Generated, Updates Test Results/Reports - Within 60 days of Test Completion, Current	A A A I
J	Electromagnetic Interference Control Plan (EMICP)	30 Days Prior to the MPDR, Preliminary April 1, 2004 Final As Generated, Updates	I A A

CH-04

DID Ltr.	Description	Due Date, Maturity	A/I	
K	Electromagnetic Interference/ Compatibility Test Plan (EMICTP)	April 1, 2004, Preliminary 90 Days After the SC CDR, Final As Generated, Updates	I A A	CH-04
L	Parts, Materials, Lubrication, and Processes Control Plan (PMLPCP)	60 Days After Contract Award, Final As Generated, Updates	A	
M	As-Designed/As-Built Parts, Materials, Lubrication, and Processes Lists	Lists - 30 Days Prior to MPDR, Initial Lists - 30 Days Prior to MCDR, Update Lists - As Generated, Updates Lists - 60 Days Prior to Hardware Shipment, Final (As Built List) Manufacturing/Fabrication Procedures/Information – Upon Request, Current	I	
N	Alert/Advisory Disposition and Preparation	Responses - 25 Calendar Days After Receipt of Alert/Advisory from GSFC, Final	I	
O	Printed Wiring Board (PWB) Coupons or Reports	As Received From Manufacturer/Evaluation Laboratory By Contractor, Final	A	
P	Observatory Contamination Control Plan (CCP)	30 Days Prior to MPDR, Initial 30 Days Prior to MCDR, Final As Generated, Updates	A	
Q	Failure Mode and Effects Analysis (FMEA) and Critical Items List (CIL)	30 Days Prior to MPDR, Initial 30 Days Prior to MCDR, Final As Generated, Updates	I	
R	Probabilistic Risk Assessment (PRA)	PRA Plan: 30 Days Prior to MPDR, Final PRA: 30 Days Prior to MCDR, Initial PRA: 30 Days Prior to MOR, Final PRA Plan and PRA: As Generated, Updates	I	
S	Reliability Assessment and Prediction	30 Days Prior to MPDR, Initial 30 Days Prior to MCDR, Final As Generated, Updates	I	
T	Fault Tree Analysis (FTA)	30 Days Prior to MPDR, Initial 30 Days Prior to MCDR, Final As Generated, Updates	I	

Title: External Interfaces, Models and Analysis	CDRL No.: 1

Reference:

Purpose:
To provide the GLAST Project (Large Area Telescope instrument, GLAST Burst Monitor instrument, and ground system teams, etc.) with spacecraft interface data, models, and analysis needed to assist them in their designs and preparations to support the Observatory for launch and mission operations.

Related Documents:

Spacecraft MAR (433-MAR-0003), GEVS-SE

Preparation Information
The contractor shall provide to the GLAST Project (Large Area Telescope instrument developer, GLAST Burst Monitor instrument developer, and ground system team, etc.) the required external interface information (data, models, and analysis) for the development of the Large Area Telescope, GLAST Burst Monitor, and ground system. This shall include as a minimum:

A. Spacecraft bus and Observatory NASTRAN finite element models (FEMs) and associated Loads Transfer Matrices (LTM's).   CH-05
B. Structural interface stress analysis.
C. Pointing and alignment budgets.
D. Spacecraft bus and Observatory thermal models and analysis.
E. Ground system protocols and data rates compatibility analysis.
F. Data contact scenarios and optimization including but not limited to contacts versus data recorder size trade study, analysis of ground station visibilities, contact geometry, and contact time.   CH-05
G. Flight dynamics and orbital maintenance analysis:
   1. All analyses and assumptions used to determine how the orbital decay due to all relevant factors (solar cycle, drag, etc.) impacts the mission lifetime;
   2. If analysis, based on updated solar cycle models (available closer to the launch date) shows that the mission lifetime would be limited, then deliver the flight dynamics and orbital maintenance analysis;
   3. Necessary to support any environmental analyses required (e.g. – atomic oxygen profile, or radiation environment, etc.) and also to show how the mission lifetime requirement is met;
   4.Orbital decay models covering the range of observatory orbit insertions possible including high, low and nominal cases. Initial orbit insertions need to take into account the initial orbit altitude specified in the MSS, combined with the three sigma orbit insertion variability of the launch vehicle.   CH-05
H. All CLA data received from KSC and the launch vehicle contractor. This includes, but is not limited to, the following CLA Output:

   For each observatory response quantity, and for each loading case analyzed in any CLA:
   1. Overall envelope summary table across all events for all LTM items
   2. Max/min LTM summary tables for each launch event across all load cases

3. Max/min LTM summary tables for each individual load case

The following additional data is also required to address instrument and observatory issues via in-house analytical capabilities.

    4. General (All Events)
- Eigenvalues for the coupled observatory/LV system
- Damping vector for the coupled observatory/LV system

    5. Liftoff
- Time history plots of observatory/LV interface acceleration and forces
- Shock response spectra (SRS) plots for interface acceleration and forces (Q=10)
- Generalized acceleration time history responses

    6. Transonic and Max-Q
- Gust SRS plots for interface accelerations and forces
- Buffet PSD plots for interface accelerations and forces
- Gust generalized acceleration time history responses
- Buffet generalized acceleration PSD responses
- Axial thrust, STEL, and dispersions necessary to calculate combined airloads responses

CH-05

I. Sine vibration test specification (flight level) for all GBM components (NaI sensors, BGO sensors, DPU and Power Boxes).
J. If vibroacoustic testing or analysis is performed for the spacecraft or observatory, then random vibration test specifications for all GBM components, (NaI sensors, BGO sensors, DPU and Power Boxes), shall be provided to GSFC.
K. Results of base drive observatory analysis (using GSFC provided observatory level sine sweep test input).
L. Load transfer matrices (LTM's) used for the recovery of GBM component (NaI sensors, BGO sensors, DPU and Power boxes) responses and the corresponding GBM responses shall be provided.
M. Quasi-static design limit loads shall be provided for all GBM components, (NaI sensors, BGO sensors, DPU and Power Boxes).

CH-05

Title: Instrument Interface Control Document (ICD)	CDRL No.: 2A – LAT; 2B - GBM

Reference:

Purpose:
To coordinate and control all interface items between the spacecraft bus and each instrument
payload to provide efficient electrical and mechanical integration and proper operation.

Related Documents:
LAT IRD (433-IRD-0001), GBM IRD (433-IRD-0002)

Preparation Information

The contractor shall provide detailed information regarding the spacecraft bus interface to each
instrument payload. The data provided by the Government, in the form of written words, drawings,
and schematics, will be incorporated into this combined Instrument and Spacecraft Bus ICD for
applicable signatures.

The Spacecraft Bus to Instrument interface is defined per the following topics as a minimum:

A. Physical Requirements - such as mass properties, dynamic propulsion (angular momentum,
    disturbance torques), footprint, clearance envelope, drill template, alignment, orientation, fields-
    of-view (optical, thermal, glint, RF), including tolerances, and special accesses. Electrical
    Connectors - regarding sex, type, orientation, pin assignments. Thermal control coatings,
    blankets, heat flow and operating limits. Red and green tag items for test and flight.

B. Electrical Power and Signals - such as timing clock pulses, data busses, signal (name, type,
    function), voltage and current limits, frequencies, waveforms, rise and fall time, duration,
    periodicity, shielding, grounding, formats, fusing, voltage, currents, ripple, regulation,
    impedance, and isolation.

C. Software - such as codes, processors, memory storage, application description, uses.

D. Payload Environmental – such as vibration, shock, acoustic, EMI/EMC, ESD, thermal,
    contamination, purges.

E. Safety - such as pyrotechnics, energy storage, trip-over, hazardous materials.

F. Ground Support Equipment - such as mechanical, electrical, test specific, targets, stimulators.

G. Operational Factors – such as ground contacts needed per day, data storage capacity, general
    flight rules and limitations.

H. Cabling and RF Waveguide - such as routing support brackets, and dummy loads.

Show sufficient detail on both sides of each interface to provide clear and complete documentation of the resultant mated
interface. For example, electrical interfaces should be presented in schematic detail (logic elements and piece parts) to the
point where impedance and transfer characteristics are fully described .

Title: Launch Vehicle Documentation LVD	CDRL No.: 3
Reference:	
Purpose: To document and define requirements and control all aspects of the interface between the Observatory and the launch vehicle to insure efficient integration and promote a successful launch to the mission orbit.	
Related Documents: Delta II Payload Planner's Guide External Interfaces, Models and Analysis, CDRL #1	
Preparation Information This deliverable set of data defines the requirements of the Observatory for the launch vehicle provider and is to include the following as a minimum: A. Spacecraft questionnaire. B. Observatory mathematical model for dynamic analysis. C. Observatory environmental test documents. D. Observatory/launch system interface specification (electrical, mechanical, data) inputs. E. Mission operations and support requirements. F. Payload (Observatory) requirements document (PRD), including facilities requirements. G. Observatory drawings. H. Electrical wiring requirements. I. Fairing requirements. J. Observatory integrated test procedure inputs. K. Mission analysis requirements. L. Launch intervals (window). M. Radio frequency applications (provide by NASA with support from contractor). N. Post-launch orbit confirmation data. O. Launch hold criteria - Observatory go/no go. P. Launch Site Test Plan Q. Launch Site Test Procedure R. Missile System Pre-Launch Safety Package (MSPSP) inputs	

Title: Observatory to Ground Interface Control Document (Obs-to-GND)	CDRL No.: 4.	CH-02

Reference:

Purpose: Documents the RF interface between the Observatory and the ground stations to be used for GLAST. Documents interface between the Observatory and the Mission Operations Center (MOC). Includes information on the interface with spacecraft and instruments.	CH-02

Related Documents:

Preparation Information

1. The Observatory to Ground Station Interface Control Document shall include the following:

1.1. Telemetry and command data formats (frame level), communications protocols, data rates.
1.2. Compression algorithms, error detection and correction schemes.
1.3. Antenna patterns, EIRP, G/T, beam width, uplink and downlink frequencies, polarizations and modulations for each channel.
1.4. Physical and virtual channel utilization and rates.
1.5. Link analysis for all available ground station antennas.

2. The Observatory to MOC Interface Control Document shall include the following:

2.1. Telemetry and command data formats (frame and packet level), communications protocols, data rates.
2.2. Compression algorithms, error detection and correction schemes.
2.3. Physical and virtual channel utilization and rates.
2.4. Command, memory, and table load formats and protocols (all types of loads).
2.5. Memory and table dump formats and protocols (all types of dumps).
2.6. Solid State Recorder (SSR) dump formats and protocols.

CH-02

Title: Observatory Operations Description Manual	CDRL No.: 5
Reference:	
Purpose: To be used by the operations organization to develop detailed operations procedures and the Observatory operations manual. Provides a description of the operation of the Observatory.	
Related Documents: Flight Operations Support Plan DID #7, Ground System ICD DID #4, Telemetry and Command Handbook DID #6	
Preparation Information Operations description manual contents: A. Overview and discussion of operations concept, including spacecraft contact scenarios for data transmission, operations and maintenance B. Description of unique factors associated with the operation of the Observatory, including orbit determination, ground station visibility prediction, ephemerides processing, command and data time tagging, operating modes and direct ground station commanding. C. Overview of internal and external Observatory interfaces. D. As applicable, identify and explain any unique ground system logistics, software, software maintenance, and sustaining engineering required for sustained Observatory operations, including spacecraft simulators E. Sample operational scenarios. F. Operation of the Observatory and all spacecraft subsystems, including attitude maneuver planning and execution. G. Contingency scenarios and procedures. H. Redundancy management. I. State of health maintenance. J. Listing of operations limits (attitude, modes), cautions, and constraints. K. All information required to successfully deorbit the observatory.	CH-02

Title: Telemetry and Command Handbook	CDRL No.: 6

Reference:

Purpose: To describe the spacecraft bus, Large Area Telescope instrument, GLAST Burst Monitor instrument telemetry and command features for launch and flight operations application.	CH-02

Related Documents:

Preparation Information

1   Telemetry contents:

    a.   Detailed listing of all telemetry assignments, including unique or additional telemetry points included for de-orbit and anomaly resolution
    b.   Key parameters and information necessary for the description and interpretation of the telemetry requirements, including virtual channel and packet information for each mode.
    c.   Summary of number and type of telemetry packet ID assignments, including spares.
    d.   Description of telemetry interfaces, format and contents of each packet type, and limits.
    e.   Listing of telemetry assignments that confirm commands.
    f.   Transmission or sampling rates.
    g.   Engineering units and calibration data, A to D for readout and calibration.

CH-02

2   Command contents:

    a.   Detailed listings of all commands that can be applied to the Observatory that can affect a response or change in its configuration in anyway, either in test or in flight.
    b.   Key parameters necessary for description of commands.
    c.   Summary of number and type of commands used by each subsystem and the number of spares.
    d.   Description of command input, verification, rates, and filler commands.
    e.   Description of command data and information necessary for interpretation.
    f.   Listing of commands verified by telemetry and telemetry verifies.

Title: Flight Operations Support Plan	CDRL No.: 7
Reference:	
Purpose: To describe the contractor's plan for performing the flight operations of the Observatory starting at integration and test, through launch, throughout the on-orbit checkout phase, and on an as needed basis by the government throughout the life of the mission. Included is how the contractor proposes to perform anomaly resolution to the end of the mission.	
Related Documents:	

Preparation Information
 	
Flight Operations Plan Contents
 	
    A. Description of roles and responsibilities and plans of how the contractor will perform the operations of the observatory during test, launch, and on-orbit checkout.
    B. Description, designation and delivery of any unique ground systems and responsibilities needed for spacecraft operations.
    C. Plan for anomaly identification, investigation, and resolution process for the life of the mission.
    D. Plan for initial and periodic performance assessments, as requested, to determine spacecraft viability and compliance with specifications.
    E. Description of complement of skills needed to perform this support and how the contractor will provide these resources.
    F. Describe at a high level the flight software documentation system, how source and executable code is generated and used, and the method(s) of maintaining associated equipment, including the SDMS.
    G. Describe configuration control methods and safeguards, how emulators are accessed or dedicated, and how software corrections or changes are verified before uploading to the bus on-orbit.
    H. Describe at a high level the plan for method of delivery, build and installation of the Flight Software (per Rapid II contract, CLIN #7) and associated documentation in the SDMS and the checkout thereof.
    I. Description of verification and validation of command procedures, telemetry parameters and databases, including methods of in-flight and ground test verification.
	CH-02

Title: Observatory Launch Site Operations and Test Plans	CDRL No.: 8

Reference:
EWR 127-1, Delta II Payload Planner's Guide as applicable

Purpose:
(1) To provide a detailed understanding of the launch site activities, operations and testing planned for a particular mission, (2) to support requirements of the MSPSP and (3) to obtain launch site procedure approvals.

Related Documents:
LAT Handling Plan (TBS), LAT Contamination Control Plan (TBS), GBM Contamination Control Plan (TBS), GBM Handling Plan (TBS)

Preparation Information
Describe all aspects of the activities at the launch site beginning with activities preceding the arrival of the Observatory, including final testing and preparations, fueling, transportation between buildings and the launch vehicle, launch vehicle integration and testing, and removal of systems after launch. The data shall be originated to support launch site "test and inspection plans" requirements and the "ground operations plan" requirements as referenced in EWR 127-1.

A. Layout a schedule and timeline of proposed activities including spacecraft, Large Area Telescope instrument, and GLAST Burst Monitor instrument testing.
B. Specify what facilities and facility resources are needed.
C. Show equipment placement and personnel area requirements.
D. Fully explain staffing plan.
E. Explain schedule and personnel contingency methods.
F. Describe roles and responsibilities and the other equipment needed at each step of the plan.
G. Describe fueling methods, crew training, Self Contained Airbreathing Protective Equipment (SCAPE) operations, fuel storage locations.
H. Address cleanness methods, purge gasses and lines, garments.
I. Identify special test equipment needed on the launch tower or in the blockhouse.

Identify specific communication links needed between locations at the launch site to perform Observatory end-to-end testing and to support the Observatory on the launch vehicle up to the point of launch.

Title: Observatory Launch Site Operations and Test Procedures	**CDRL No.:** 9

Reference:
EWR 127-1
Missile System Prelaunch Data Package (MSPSP), Spacecraft MAR - DID E
Delta II Payload Planner's Guides as applicable
Observatory Launch Site Operations and Test Plans DID # 8

Purpose:
To document the complete understanding of how the planned activities are to be carried out at the launch site to meet requirements of (1) MSPSP, (2) launch site operations and test plan, (3) test and inspection plans and (4) procedure approval specified in EWR 127-1.

Related Documents:
 LAT Handling Plan (TBS), LAT Contamination Control Plan (TBS), GBM Contamination Control Plan (TBS), GBM Handling Plan (TBS)

Preparation Information

For all of the activities at the launch site, most of which are identified in the referenced Observatory Launch Site Operations and Test Plans, DID# 8, detailed procedures are to be prepared, reviewed, and approved before use. Hazardous activities shall be identified and included in the referenced MSPSP, Spacecraft MAR - DID E. Specify in the procedures, the test objectives, personnel, and equipment requirements, environmental handling needs, include LAT, GBM and spacecraft bus electrical tests to be performed, battery conditioning, special calibrations, end-to-end type testing, red tags, green tags, load cells, optical alignment equipment, etc.

Particular interest will be paid to the period of time that the Observatory is mated to the launch vehicle to assure safety, smooth interaction between Observatory and launch vehicle activities and a successful launch.

Title: Transportation and Handling Plan	**CDRL No.:** 10
Reference:	

Purpose:
To describe the contractor's role, responsibility, and plans to ship the Observatory   with the supporting equipment, from the integration and test facility to the launch site.

Related Documents:
LAT Handling Plan (TBS); GBM Handling Plan (TBS)

Preparation Information
The data provided in the plan should address the following as a minimum:

A. Definition of storage related activities including: locations; methods; GSE; environmental controls and monitoring; and pre-, post-, or intermittent storage testing required.
B. Description of shipping container.
C. Methods of transporting Observatory and ground support equipment.
D. Bagging and purging requirements.
E. Environmental controls and monitoring equipment.
F. Expected roles and responsibilities of the contractor and the Government.
G. Description of transportation/arrangements.
H. Shipping crew support, convoy support.
I. Off-loading of Observatory at the launch site.
J. Movement between facilities at the launch site.
K. Fueling GSE.
L. Lifting slings.
M. Electrical and mechanical support equipment general description.

Identify specific procedures available or needed.

Title: Engineering Change Proposals (ECPs), Deviations and Waivers	CDRL No.: 11
Reference:	
Purpose:	
Related Documents:	

Preparation Information

The contractor shall prepare and submit class I engineering change proposals (ECPs) using MIL-STD-973, ECP forms DG 1692 and DD1692-1 as guidelines. In addition to the change description, the ECP shall contain sufficient information in the form of attachments, drawings, test results, etc., to allow the Government to evaluate the total impact of the proposed change. GSFC may direct the contractor to prepare ECPs under the "changes" clause of the contract. The contractor shall allow access to class II changes for Government review.

For the purposes of this DID, a class I ECP is a change that:

A. Affects any NASA contract specification or interface requirement.
B. affects schedules of end item deliverables to the Government.
C. impacts Government furnished equipment/property.

Waivers and deviations shall be handled using MIL-STD-973 as a guide.

Title: Software Management Plan (SMP)	**CDRL No.:** 12

Reference:
Section 4.3.6.1-Software Management, Requirements, Development, Verification, and Testing

Purpose:
This document describes the contractor's overall systematic approach to and processes used in the management, design, development, testing (all phases), documentation, configuration management, and assurance of the Flight Software and associated software products such as simulators and EGSE software.

Related Documents:
The Software Management Plan shall be prepared IAW the full contents of NASA-Software Documentation Standard (NASA STD-2100-91), Data Item Descriptor NASA-DID-M000 (thru – M700). Alternatively, the contractor may, with agreement from the government, use an alternative industry standard SMP approach such as MIL-STD-498 (DID DI-IPSC-81427A),IEEE standards, or suitable existing contractor format.

Preparation Information

The contractor is encouraged to use their baselined RSDO Rapid II Software Management Plan, if appropriate, with change pages for additions and deletions for the uniqueness of the GLAST mission.

Content per the NASA STD-2100-91 or equivalent shall be retained.

Title: Software Requirements Specification (SRS)	CDRL No.: 13

Reference:
Section 4.3.6.1-Software Management, Requirements, Development, Verification, and Testing

Purpose:
The Software Requirements Specification specifies in detail all the requirements for a particular Computer Software Configuration Item (CSCI), including functional and performance requirements, testing requirements, security and safety requirements. A traceability matrix shall be included in the SRS that maps each software requirement to a system or sub-system (higher level) requirement from which it is derived. Additionally, the test method used to verify each requirement will be identified.

Related Documents:
The Software Requirements Specification shall be prepared IAW the full contents of NASA-Software Documentation Standard (NASA STD-2100-91), Data Item Descriptor NASA-DID-P200. Alternatively, the contractor may, with agreement from the government, use an alternative industry standard SRS approach such as MIL-STD-498 (DID DI-IPSC-81433A),IEEE standards, or suitable existing contractor format.

Preparation Information

The contractor is encouraged to use their baselined RSDO Rapid II Software Requirements Specification, if appropriate, with change pages for additions and deletions for the uniqueness of the GLAST mission.

Content per the NASA STD-2100-91 or equivalent shall be retained.

Title: Software Design Document (SDD)	**CDRL No.:** 14
Reference: Section 4.3.6.1-SoftwareManagement Requirements, Development, Verification, and Testing	
Purpose: The Software Design Document describes in detail the architecture, structure, and organization of a particular Computer Software Configuration Item (CSCI), decomposing the top-level CSCI into Computer Software Components (CSC) and lower levels of units as appropriate. The SDD describes each unit of software in terms of its interfaces (input/output), data architectures, and processing (e.g. logic, algorithms).	
Related Documents: The Software Design Document shall be prepared IAW the full contents of NASA-Software Documentation Standard (NASA STD-2100-91), Data Item Descriptor NASA-DID-P300/400. Alternatively, the contractor may, with agreement from the government, use an alternative industry standard SDD approach such as MIL-STD-498 (DID DI-IPSC-81435A), IEEE standards, or suitable existing contractor format.	
Preparation Information The contractor is encouraged to use their baselined RSDO Rapid II Software Design Document, if appropriate, with change pages for additions and deletions for the uniqueness of the GLAST mission. Content per the NASA STD-2100-91 or equivalent shall be retained.	

Title: Software Test Package (STP)	**CDRL No.:** 15
Reference: Section 4.3.6.1-Software Management, Requirements, Development, Verification, and Testing	

Purpose:
The Plan section of the Software Test Package describes the total strategy, methodology, and approach for the complete testing of a particular Computer Software Configuration Item (CSCI) and each of the Computer Software Components (CSCs) and units thereof. The STP Plan section details the formal acceptance testing strategy of the fully integrated CSCI. The STP Plan section shall identify and describe the test environment for each phase of testing. Any software requirements which require the full satellite for testing shall be identified. The STP shall contain a traceability matrix which maps all test cases, procedures/descriptions to a corresponding requirement(s) in the SRS. The Procedures portion of the Software Test Package contains the step-by-step procedures for implementing each software test. This includes the detailed procedures for data reduction and the analysis of test results. Computer-based automated test procedures implemented by the contractor to automate the software testing shall be included in the document or as an appendix. The Report section of the Software Test Package records the results of all formal acceptance testing of a particular Computer Software Configuration Item (CSCI), including test history logs..

Related Documents:
The Software Test Package shall be prepared IAW the full contents of NASA-Software Documentation Standard (NASA STD-2100-91), Data Item Descriptor NASA-DID-A000/A100/A200/R009. Alternatively, the contractor may, with agreement from the government, use an alternative industry standard STP approach such as MIL-STD-498 (DID DI-IPSC-81438A, DID DI-IPSC-81439A), IEEE standards, or similar contractor format.

Preparation Information
The contractor is encouraged to use their baselined RSDO Rapid II Software Test Package, if appropriate, with change pages for additions and deletions for the uniqueness of the GLAST mission. The Planning portions of the Software Test Package, including the traceability matrices shall be delivered in advance of the Procedures and Reports sections of the package.

Title: DELETED	**CDRL No.:** 16
Reference:	
Purpose:	
Related Documents: .	
Preparation Information	

Title: DELETED	CDRL No.: 17
Reference:	
Purpose:	
Related Documents:	
Preparation Information	

Title: Version Description Document (VDD)	**CDRL No.:** 18
Reference: Section 4.3.6.1-Software Management, Requirements, Development, Verification, and Testing	

Purpose:

The FSW Version Description Document (VDD) describes in detail the contents of a particular specified version of the Flight Software CSCI. The VDD includes the procedures for generating, building, compiling, and linking it, as well as the files it contains, and the changes from the previous version. This should also include any tested and verified Change Requests or Problem Reports contained in this version of the FSW.

Related Documents:

The FSW VDD shall be prepared IAW the full contents of NASA-Software Documentation Standard (NASA STD-2100-91), Data Item Descriptor NASA-DID-P500. Alternatively, the contractor may, with agreement from the government, use an alternative industry standard SDD approach such as MIL-STD-498 (DID DI-IPSC-81442A) or IEEE standards.

Preparation Information

The contractor is encouraged to use their baselined RSDO Rapid II Version Description Document template, if appropriate, with specifics for the uniqueness of the GLAST mission.

Content per the NASA STD-2100-91 or equivalent shall be retained.

Title: Flight Software User and Maintenance Manual (SUMM)	**CDRL No.:** 19
Reference: Section 4.3.6.1-Software Management, Requirements, Development, Verification, and Testing	
Purpose: The Flight Software User and Maintenance Manual (SUMM) shall contain the information required to use and maintain the software, including detailed procedures for building, linking, troubleshooting and "patching" (i.e. fixing / modifying / replacing portions of) the flight software.	
Related Documents: The FSW VDD shall be prepared IAW the full contents of NASA-Software Documentation Standard (NASA STD-2100-91), Data Item Descriptor NASA-DID-P600/700. Alternatively, the contractor may, with agreement from the government, use an alternative industry standard SDD approach such as MIL-STD-498 (DID DI-IPSC-81443A) or IEEE standards.	
Preparation Information The contractor is encouraged to use their baselined RSDO Rapid II Software User / Maintenance Manual template, if appropriate, with specifics for the uniqueness of the GLAST mission. Content per the NASA STD-2100-91 or equivalent shall be retained.	

Title: DELETED	CDRL No.: 20
Reference:	
Purpose:	
Related Documents:	
Preparation Information	

Title: Flight Software Review Packages	CDRL No.: 21
Reference: Section 4.3.6.1-Software Management, Requirements, Development, Verification, and Testing	
Purpose: The contractor shall hold reviews for Flight Software which may be scheduled adjacent mission (or other) reviews but which are held separately. These reviews shall provide a greater understanding and in-depth look at the flight software, the processes in use to design, implement, test and verify.	
Related Documents:	

Preparation Information

Review packages for software reviews:

- Flight Software Requirements Review
  - Review of Software Requirements,
  - Traceability to System Requirements
  - Cost, Schedule, Driver Requirements identified.
  - Risk and Mitigation strategies for these
  - Requirements management approach, tools
  - Status of Requirements related deliverables
  - Test philosophy, test tools
- Flight Software Preliminary Design Review
  - Software Management Plan
    - Organization/WBS/Project relationship
    - Deliverables and schedules, time budgets
    - CM and Product Assurance Approach, Tools
    - Requirements and Interface management
    - Development Tools and Approach
    - SW CDRL status
    - Risk Management Approach
    - Risks Identified; Mitigations
    - Test approach and test planning status
  - Technical
    - Requirements Analysis Update
    - Software Architecture – task and/or functional allocations
    - Internal Interface identification (ICD?)
    - External Interfaces identification (ICD?)
    - Fault Detection, Isolation, & Recovery (FDIR) strategy
    - Identified Technical Risks; Mitigation
- Flight Software Critical Design Review
  - Programmatic Overview – Management
    - Deliverables and schedules, time budgets update
    - SW CDRL status - update
    - Product Assurance methods and findings - update
  - Technical
    - On a component, task, class, thread or other functional block boundary: cover function/requirement, inputs/outputs, timing/sizing estimates, throughput requirements, command inputs, telemetry and status outputs.
    - For GNC software cover the state diagrams, transitions, and review the modeling elements and algorithms designed.
    - For C&DH software cover the interface and risk reduction testing to date, processing data flows (transaction diagrams), and throughput.
    - For thermal and power management software, present algorithms, limit conditions and error responses for these software components.
    - For test software and simulations identified to meet requirements, review the status and technical progress on these elements.
    - Risks, Issues and Mitigation
- Flight Software Test Ready Review
  - Programmatic Update – Management
    - Deliverables and schedules, time budgets update
    - SW CDRL status - update
    - Product Assurance - update

- o Technical
  - On a component, task, class, thread or other functional block boundary: cover integration efforts and level of testing completed.
  - For software supporting key and driver requirements identified at the SRR, provide test results reflecting the maturity and rigor of their testing.
  - For test and simulation equipment, review status and availability
  - Review current list of software problem reports and efforts/schedule to resolve and unit re-test.
  - Risks, Issues and Mitigation
- Flight Software Acceptance Test Review.
  - o Programmatic Update – Management
    - Deliverables and schedules
    - SW CDRL status - update
    - Product Assurance - update
  - o Technical
    - Review of testing and acceptance status of full software system.
    - Review current list of software related problem reports and efforts/schedule to resolve and re-test.
    - For software requirements not yet meeting acceptance, describe path to success.
    - Risks, Issues and Mitigation
  - o

The contractor is encouraged to use their baselined RSDO Rapid II review material, if appropriate, with specifics for the uniqueness of the GLAST mission.

Title: DELETED	CDRL No.: 22
Reference:	
Purpose:	
Related Documents:	
Preparation Information	

Title: Observatory to Space Network RF Interface Control Document Input	CDRL No.: 23	CH-02

Reference:

Purpose:
Documents the spacecraft RF characteristics for the spacecraft to Space Network (TDRSS) interface. This information will be used by NASA to generate the Spacecraft to SN ICD. This CDRL is the input required by the SN.

CH-02

Related Documents:

Preparation Information

The Observatory-Space Network Interface Control Document input shall include the following:
- A. Data formats, communications protocols, data rates.
- B. Compression algorithms, error detection and correction schemes.
- C. Antenna patterns, EIRP, G/T, beam width, uplink and downlink frequencies, polarizations and modulations for each channel.
- D. Physical and virtual channel utilization and rates.

CH-02

Title: Monthly Program Status Review (MPSR) Package	CDRL No.: 24
Reference:	
Purpose:	
Related Documents: None	

Preparation Information

The following information shall be provided:
1. Status of work being performed including appropriate metrics.
2. Detailed status of schedule and integrated project schedule.
3. Status of project staffing and any shortages.
4. Milestone Monitoring - The contractor shall report on the status of progress made toward accomplishing each of his major milestones. Each report shall include a listing of major accomplishments and a discussion of any problems associated with each milestone as well as their resolution.
5. Status of technical issues and risks.
6. Changes to design parameters such as mass, power profile, communications, system performance, etc.
7. Resource allocations and margins (telemetry, commands, power, mass, data storage, processor capability, etc.)
8. Margins as a function of time and design maturity; track the resource against the budget
9. Descriptions and status of technical problems and the resolutions.
10. Subcontract technical performance, manpower resources, schedule, and milestone status.
11. Performance assurance status including non-conformance reports and failure report dispositions.

Title: Weekly Status Teleconference Package	**CDRL No.:** 25
Reference:	
Purpose:	
Related Documents: None	

Preparation Information

The following information shall be provided as part of the Weekly Teleconference:

1. DO activities, plans, and progress against those plans.
2. Review of calendar of upcoming meetings, events, and previous actions.
3. Descriptions and status of technical problems and the resolutions.
4. Status of technical issues and risks.
5. Issues and Action Items.

Title: DELETED	CDRL No.: 26
Reference:	
Purpose:	
Related Documents:	
Preparation Information	

Title: Observatory photographs and video tapes	CDRL No.: 27

Reference:
SOW

Use:
Program status reviews; system, subsystem, and component packaging evaluations; and trouble-shooting.

Related Documents
None

Preparation Information:

A. Still Photography

    1. Pictures shall be made at appropriate points in the development of the Spacecraft and Observatory.   CH-03

    2. Pictures shall be made of the major subsystems, critical components, the full-up system, and major GSE items.   CH-03

    3. The pictures shall serve as a record of the build-up of a major component or subsystem; e.g., a typical electronic card, motherboard, electronic subsystem with cover off, etc.

    4. Pictures of environmental test fixtures shall also be provided.

    5. All pictures shall be in color and annotated and measure 8 X 10 inches. The Contractor shall provide 4 hard copies of each item except for the full-up system which shall require 6 hard copies of the Spacecraft and Observatory. Negatives or high quality digital images shall also be provided for all pictures.   CH-03

B. Video

    6. Video tape (1/2 inch VHS format) or DVDs shall also be made at appropriate points in the development of the Spacecraft and Observatory.   CH-03

    7. Real-time video of the Spacecraft and Observatory integration and test shall be available through a website.   All personnel involved shall have access to this website.

    8. Assembly of the Observatory shall be videotaped in sufficient detail to be used for training and possible failure investigation.   CH-03

Title: DELETED	**CDRL No.:** 28
Reference:	
Purpose:	
Related Documents:	
Preparation Information	

Title: Observatory Detailed Requirements, Traceability and Verification	CDRL No.: 29

Reference:
GLAST Science Requirements Document, Mission Systems Specification, Spacecraft Performance Specification, SC-LAT IRD, SC-GBM IRD, SC MAR, EMI Requirements Document

Purpose:

 a. To document the results of the contractor's requirements analysis, allocation, and controlactivities, as described in the GLAST SOW section 4.3.2 and elsewhere in the Delivery Order (DO), for spacecraft and observatory requirements as derived from all documents in the DO and determined for undefined interfaces not explicitly defined by the government (eg. launch vehicle, Ops Concept to derive operational modes for the observatory, instrument interfaces, etc.). The DO consists of the SOW, CDRLs, SRD, MSS, SPS, MAR, IRDs, and all other documents included in the spacecraft contract. [Per SOW section 4.3.2, these interfaces shall then be defined, documented, verified, and controlled for the duration of the contract, by the contractor and approved by the government.]

b. To document the validation of the GLAST Observatory requirements – that the observatory will meet the mission objectives, be capable of performing the measurement concept, accommodate the instrument concept, interface properly with the launch vehicle, the NASA communication network, and operates as defined in the operation concept.

Related Documents:
All GLAST Interface Control Documents, LAT Requirements, GBM Requirements, Delta Payload Planner's Guide, etc.

CH-01

Preparation Information

1. The contractor shall deliver a document that specifies detailed integrated system and subsystem requirements of the spacecraft (detailed spacecraft requirements document). To avoid duplication, Interface Control Document entries (instrument, launch vehicle, ground system, etc.) need not be duplicated in the detailed spacecraft requirements document.
2. The contractor shall document the top-down traceability of all observatory requirements as well as the linkages between lower level requirements on different subsystems to document the validation of the observatory requirements and allow the assessment of any proposed changes in requirements (including the addition of new and derived requirements). The observatory requirements specified in the Delivery Order (SOW, SRD, MSS, SPS, MAR, IRDs, CDRLs, etc.) must be fulfilled by the contractor. The top-down traceability of observatory requirements shall extend to the instruments by identifying which requirements shall extend to the instruments and identifying which requirements and aspects of requirements are owned wholly by the instrument providers. In doing so, this document may incorporate references to other documents , such as the LAT and GBM performance specifications. All integrated observatory requirements necessary to make the GLAST mission a success shall be identified.

3. The contractor shall deliver a detailed verification matrix for the performance verification of the integrated observatory requirements. The matrix shall show all requirements that the contractor plans to verify to make the GLAST mission a success. The contractor is expected to integrate the efforts of the instrument providers to verify instrument requirements at the observatory level. The matrix shall show the contractor's approach to verify the requirements, including the method of verification (test, analysis, inspection, demonstration) as well as the level of verification (component, subsystem, integration, observatory, on-orbit, etc.)

4. Other than the scheduled deliveries, all changes shall be submitted to the government as updates for approval.

CH-01

Title: GLAST Project Control Plan	CDRL No.: 30
Reference: Rapid II Contract	

Purpose:

To describe and document the specific project management, systems engineering, and systems assurance activities planned to be conducted to meet the requirements of this DO.

Related Documents: All GLAST technical and programmatic (except cost) documentation

Preparation Information

The Project Control Plan shall be prepared as required under the Rapid II contract, RFO5-00651-311, Section III, Enclosure 3, following the contractor's internal standards and procedures (which shall be available for inspection by the government) consistent with ANSI/ASQC requirements and the GLAST Spacecraft MAR (where applicable). The contractor is encouraged to start from any baseline Rapid II Project Control Plan that may be available and modify it to meet the GLAST mission unique requirements of this DO.

Special emphasis shall be placed on the GLAST mission unique activities including, but not limited to:

1. the accommodation of the LAT and GBM instruments on the spacecraft,
2. the accommodation of the system level test and calibration requirements of the LAT and GBM instruments during the observatory level and end-to-end testing, and mission simulations,
3. the accommodation of the on-orbit calibration requirements of the LAT instrument,
4. defining and managing external interfaces,
5. the flexibility of the project management and the systems engineering approach to reduce both the technical risk and the schedule risk,
6. the approach to a comprehensive and critical analysis of all science and technical requirements on the observatory documented in the SRD, MSS, SPS, IRDs and other documents,
7. the design options analyzed and traded to satisfy requirements, with emphasis on the GLAST mission unique requirements,
8. the traceability of the requirements to specific design solutions adopted,
9. the design and implementation of the requirements data base,
10. the methodology for assessing the technical and schedule impacts of requirements changes and the procedures for configuration control,
11. identification and brief descriptions of the special studies, trades, and analyses of the GLAST mission unique requirements,
12. master schedules for the project – milestone and network, with critical paths identified and the resources applied to the tasks on the critical paths

Title: DELETED	CDRL No.: 31
Reference:	
Purpose:	
Related Documents:	
Preparation Information	

Title: GN & C Detailed Design Document	**CDRL No.:** 32
Reference:	
Purpose: The GN & C Detailed Design Document shall include the design of the guidance, navigation, and control subsystem, including algorithms, to assist in design evaluations, on-orbit operations and anomaly resolution.	
Related Documents: Observatory Operations Description Manual Software Requirements Specification (SRS)	
Preparation Information The contractor shall prepare and provide a GN&C Detailed Design Document which contains a complete physical and mathematical description of the GN&C subsystem including, but not limited to, the following information: 1. Coordinate frame definitions as appropriate for all components, and any auxiliary reference frames defined. 2. All conversion factors between sensor/actuator signals and engineering units used in GN&C control software. 3. Software parameters (gains, filter parameters, etc) with appropriate explanatory notes and references to telemetry tables. 4. Functional block diagrams for all control modes. 5. Stability analysis results for all control modes. 6. Representative simulation results, including both nominal behavior and response to anomalies. 7. Description of all data processing and algorithms in sufficient detail so as to permit stability analysis and performance evaluation (including computer simulation) by the government. 8. Operational considerations of the GN&C subsystem to support required control functions and operational modes to meet the science objectives and operational requirements. This document shall be the source for many of the software requirements and shall contain the appropriate information for requirements flowdown to the Software Requirements Specification.	

Title: Definition of LAT Power Feeds	CDRL No.: 33
Reference: Large Area Telescope Instrument-Spacecraft Interface Requirements Document (LAT IRD)	
Purpose: To define the number and current rating for the LAT Power Feeds	
Related Documents:	
Preparation Information The Contractor shall define the LAT Power Feeds in accordance with the requirements of section 3.2.4.1.6.1 "Definition of Feeds" of the LAT IRD.	

Title: 60 Day On-Orbit Performance Verification Report	CDRL No.: 34
Reference:	
Purpose: To summarize the spacecraft bus performance on-orbit after launch and check-out to determine initial mission success and completion payment milestone status	
Related Documents:	
Preparation Information The contractor shall prepare a report which summarizes the on-orbit performance of the spacecraft bus compared to its predicted performance for the GLAST mission after launch. Each subsystem shall be addressed and the performance of the launch and flight operations crews shall be included. All pertinent issues affecting mission success shall be addressed. The extent of performance explanation required depends on the seriousness of the impacts that any problems identified may have on mission success.	

Title: MOC Training Simulator Review Data Packages	**CDRL No.:** 35
Reference:	
Purpose: The MOC Training Simulator is used by the Flight Operations Team to develop spacecraft procedures, create real time display pages, and to perform the role of the spacecraft in the mission simulations.	
Related Documents: TBS	

Preparation Information
The contractor shall provide the following data for each type of review.
1. Requirements Review
    1.1 Organizational Interfaces
    1.2 Technical Interfaces
    1.3 System Requirements
    1.4 Technical/Performance Requirements
    1.5 User Requirements
    1.6 System Drivers
    1.7 Requirements Verification Methodology
 	
2. Design Reviews
    2.1 Requirements Overview
    2.2 Changes since last Review
    2.2 Technical Approach
    2.3 Top Level Design
    2.4 Design Heritage
    2.5 System Interfaces
    2.6 Predicted Performance
    2.7 Operational Considerations
    2.8 Reliability
    2.9 Schedules
    2.10 Issues/Open Items
 	
3. Build Reviews
    3.1.Requirements Affected
    3.2 Changes since last Review
    3.3 Detailed Design Changes
    3.4 System Wide Effects
    3.5 Performance Impacts
    3.6 Test Results
    3.7Operational Considerations
    3.8 Schedule Updates
    3.9 Issues/Open Items	

Special Preparation Instructions This item can be delivered in multiple volumes and volumes can have different delivery dates if there is good reason. This CDRL item may not be required in the event that the government exercises Option 13 and is not part of the baseline contract.	

Title: MOC Training Simulator Users, Operators and Maintenance Manuals	**CDRL No.:** 36
Reference:	

Purpose:

      The MOC Training Simulator is used by the Flight Operations Team to develop spacecraft procedures, create real time display pages, and to perform the role of the spacecraft in the mission simulations. The contractor shall provide a complete reference on all aspects of the training simulator to assure the ability to setup, use, troubleshoot, repair and modify the training simulator.

Related Documents:

TBS

Preparation Information

The data required to perform this activity is as follows:

1. Description of Capabilities – describes features, capacities, and limitations if the training simulator and its displays.
2. Normal Configuration and Usage – step by step setup, initialization, execution, and shutdown instructions including error avoidance and recovery.
3. Saving Simulation Status – method by which the user can suspend the simulation for future use.
4. Fast-Forwarding – describes how to run the simulator faster than realtime. Discuss constraints on non-realtime simulations.
5. Test Modes – delineates all possible operational modes of the training simulator.
6. Graphics Interfaces – complete description of the operation of all graphics available to the simulator.
7. Component Interfaces – describes each and every component within the training simulator and shows how it interfaces to the rest of the ground system.
8. Modes of Operation – detailed description of all modes of operation of the training simulator and the appropriate display pages.
9. Anomaly Modeling – describes the types of anomalies that can be simulated and the means of producing them.
10. Requirements Specification – the complete set of requirements provided to the designers of the training simulator.
11. Detailed Design Document – all documentation on the final design including system architecture, platform selection criteria, module connectivities, error-handling capabilities, system expansion methodology, and user interfaces.
12. Hardware Design Specification – all documentation used in the selection fabrication, installation, and integration of the hardware components of the emulator.
13. Acceptance Test Plan, Procedures, and Reports – all documentation regarding the acceptance of the simulator including results of all tests performed, all procedures run against the simulator and the final acceptance report for the training simulator.
14. Version Description Document – precise report for each new build of the training simulator that describes each change to hardware or software, including the change request, date requested and date released.

Special Preparation Instructions

This item can be delivered in multiple volumes and volumes can have different delivery dates if there is good reason.

This CDRL item may not be required in the event that the government exercises Option 13 and is not part of the baseline contract.